

ARTICLE XIX. — THE NORTH AMERICAN ANTS OF THE GENUS
DOLICHODERMUS.

By WILLIAM HENRY WHEELER.

PLATES XII AND XIII.

Four species of the mainly tropical genus *Dolichoderus* have been recorded from America north of Mexico and the West Indies, namely: *D. morio* Forst., *schuchenbergi* Mayr., *plagiatus* Mayr., and *parvulus* Mayr. When in 1888 the latter author published a comparative description of all of these forms, he called attention to their close affinity with the single European and Siberian species, *D. quadripunctatus* L., and to their still closer relationship with one another.¹ Mayr even maintained that the four forms might be regarded as varieties of a single species, but owing to the absence of consistent variations he preferred to let them stand as separate species. They were based on worker specimens, though he briefly described the females of *morio* and *parvulus*.

That during the past twenty years our meagre knowledge of these interesting ants has remained in this gap, must be largely, if not exclusively, due to their scarcity or extremely local distribution. Having recently found two of the species, *D. morio* and a variety of *schuchenbergi*, rather common in the pine-barrens about Lakeland, New Jersey, I decided to study the peculiarly North American *Dolichoderus* in my collection and to publish a revision of the species, together with some notes on their hitherto unknown habits. As a result of this study, I cannot say that I am prepared to merge all four so-called species into one, but nevertheless I feel certain that *parvulus* is merely a subspecies of *plagiatus*. The only differences I can detect between these two forms are in size, sculpture, and coloration. Among my specimens there are individuals representing a distinct variety or subspecies of each of the four Mayrian species, and showing that these, like most of our North American ants, are decidedly variable. I am able to add descriptions of the male of *morio* and of the male and female of the typical *plagiatus*.

It is a singular fact that the *Dolichoderus* of America north of Mexico and the West Indies are all confined to the humid eastern portion of the continent. At any rate none of the species is known to inhabit

¹U. S. Geographical Soc. *Smithsonian Studies* vol. 10, pp. 1-10. New York, 1888. Pp. 1-10, and 101.

the arid Southwestern and Pacific States. I have searched diligently but in vain for these ants in Texas, New Mexico, Arizona, and Colorado. In these regions *Dolichoderus* is represented taxonomically as well as ethologically by another genus of the same subfamily, *Liometopum*. *D. plagiatus* is almost subboreal in its distribution. It is found as far north as Canada (*teste* Abbé Provancher) and when occurring further south prefers sunny glades on hills or mountains. *D. mariæ* is known to occur as far north as Connecticut (Emery), but both this species and *taschenbergi* are properly members of the Carolinian zone.

DESCRIPTIONS OF NORTH AMERICAN DOLICHODERI.

The workers of our different *Dolichoderi* may be identified with the aid of the following table:

1. Head and thorax with shallow foveolæ, shining..... 2
Head and thorax coarsely and deeply foveolate, subopaque..... 4
2. Epinotal concavity with a strong median longitudinal ridge; head, thorax, and petiole yellowish red..... 3
Epinotal concavity without such a ridge; at least the head black..... 5
3. Body hairless above..... *D. mariæ* Forel
At least the upper surface of head and thorax with erect hairs..... *mariæ davisi* subsp. nov.
4. Base of gaster with reddish-yellow spots..... *plagiatus* Mayr
Gaster entirely black..... *plagiatus* var. *inornatus* var. nov.
5. Without erect hairs on the upper surface; body and legs deep black or very dark brown..... 6
With erect hairs on the upper surface; thorax reddish brown..... 7
6. Body black or brown-black, legs dark brown..... *taschenbergi* Mayr
Body and appendages deep black..... *taschenbergi* var. *gagates* var. nov.
7. Base of gaster with reddish yellow spots..... *plagiatus pustulatus* Mayr
Gaster entirely black..... *pustulatus* var. *beutenmuelleri* Wheeler

Dolichoderus mariæ Forel.

- Dolichoderus mariæ* FOREL, Bull. Soc. Vaud. Sc. Nat., XX, pp. 34, 35. ♂
Dolichoderus mariæ MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XXXVI, 1886, pp. 436, 437. ♀ ♀
Dolichoderus mariæ DALLA TORRE, Catalog. Hymenop., VII, 1893, p. 159.
Dolichoderus mariæ EMERY, Zool. Jahrb. Abth. f. System., VIII, 1894, p. 330.
Dolichoderus mariæ EMERY, 27th Ann. Rep. State Board Agr. New Jersey (1899), 1900, p. 540.
Dolichoderus mariæ WHEELER, Bull. Am. Mus. Nat. Hist., XX, 1904, p. 304.

Worker (Fig. A).—Length 3.5–4.5 mm.

Head subelliptical, sides evenly rounded; occipital border rather straight; eyes placed a little in front of the middle. Clypeus flat, its anterior border

distinctly emarginate and impressed in the middle. Antennal scape curved at the base, its tip extending a distance equal to its own diameter beyond the posterior corner of the head. Funicular joints all distinctly longer than broad; two basal longer than the succeeding joints; first joint nearly $1\frac{1}{2}$ times as long as the second; terminal joint somewhat longer than the two preceding joints taken together. Thorax in profile with rounded promesonotal surfaces, the former somewhat flattened behind; mesoepinotal constriction deep. Epinotum with convex basal surface, slightly flattened in the middle, nearly as long as the mesonotum and suddenly passing by a sharp edge into the very concave declivity. Seen from above the prothorax is robust; the meso- and epinotum much narrower and laterally compressed. The sharp margin between the two epinotal surfaces is broadly rounded when seen from above and extends downward on either side to the metasternal region. There is a distinct median keel on the epinotal concavity. Petiole robust, as broad as the epinotum, but not as high as the margin between the two epinotal surfaces, with shorter and more convex anterior, and longer and flatter posterior surface; dorsal margin of node blunt and, when seen from behind, straight and transverse. Gaster broad, somewhat flattened above, first segment with a straight anterior border; constriction between the first and second segments somewhat deeper than between the succeeding segments.

Whole body smooth and shining. Mandibles with a few widely scattered, coarse punctures. Clypeus with very fine longitudinal striæ. Head, thorax, and petiole finely reticulate, with shallow foveolæ, most distinct on the posterior portion of the head and on the meso- and epinotum, but especially on the last. Epinotal concavity shining, longitudinally striated. Gaster and legs very finely reticulate, more glabrous than the other portions of the body except the mandibles.



Fig. A. *Dolichoderus maria* Forel. Worker.

Body naked, except for a few yellowish hairs on the clypeus, mandibles, lower surface and tip of gaster, coxæ, and flexor surfaces of the femora. Pubescence pale, very sparse and indistinct except on the gaster, cheeks, and antennal funiculi.

Yellowish blood-red, terminal half of antennal funiculi black. Gaster black, with the anterior half of the first and a rather square blotch on either side of the second segment near its anterior border, yellow.

Female.—Length 4–4.5 mm.

Differs from the worker in the following characters: Clypeus convex, with a very distinct median notch. Eyes larger, ocelli present. Epinotum with convex, evenly rounded basal surface, passing into the concave surface through a rounded angle; both surfaces of equal length. Head, thorax, and petiole much smoother, quite as glabrous as the gaster. Epinotum above with

shallow foveolæ, finely rugulose on the sides. Pilosity like that of the worker except that the hairs are longer on the venter. Color like that of the worker except that the head, thorax, and petiole, and the spots on the gaster are more yellow even in fully mature specimens. Each ocellus with a small brown spot. Mesonotum and posterior edge of scutellum dark brown. Wings colorless, with colorless veins and very pale yellow stigma.

Male.—Length 5-5.5 mm.

Head, including the eyes, broader than long; posterior portion evenly rounded, cheeks short, converging in front. Mandibles well developed, with denticulate blades, overlapping each other. Clypeus somewhat flattened, its anterior border without a median notch. Eyes and ocelli large and prominent. Antennæ long, all the joints longer than broad; scape rather short, as long as the first and second funicular joints together; first about half as long as the succeeding joints, which are cylindrical and subequal. Thorax robust, through the wing insertions as broad as the head through the eyes. Epinotum convex, its basal surface passing into the declivity through a broadly rounded angle. Petiole erect, low, very thick and blunt above; in profile with flat and sloping anterior and convex posterior surface. Seen from behind the upper border is straight or slightly impressed in the middle. Gaster like that of the worker but more slender and without the distinct constriction between the first and second segments. Genitalia small and embedded. Legs slender.

Mandibles smooth and shining, very sparsely and coarsely punctate. Clypeus concentrically striated, smooth in the middle. Head subopaque, densely reticulate-punctate. Thorax more shining and finely reticulate and gaster glabrous and still more delicately reticulate. Sides of scutellum sharply striated.

Pilosity and pubescence similar to those of the worker.

Deep black; tarsi and mouth-parts brown; mandibles, outer corners of clypeus, first funicular joint, wing-insertions, trochanters, and inner genital valves, honey yellow. Wings like those of the female.

The types of this beautiful species are from Vineland, New Jersey. They are in the collection of Professor A. Forel. I have seen workers from the District of Columbia, Black Mountains, North Carolina, and Manumuskin and Clementon, New Jersey, and all three phases from Lakehurst in the same State. The species has been recorded also from Virginia (Mayr) and Connecticut (Emery).

Dolichoderus mariæ davisi subsp. nov.

Worker.—Differs from the worker of the typical *mariæ* in its somewhat smaller size (2.75-3.5 mm.) and in the following characters: The basal surface of the epinotum has its greatest convexity behind the middle instead of at or very near the middle as in the typical *mariæ*. The antero-median surface of the petiole is more impressed and the edge is sharper. The sculpture of the head and thorax is more pronounced, so that these parts appear to be subopaque. The red portions of the body are duller and somewhat brownish. The most striking character, however, is the abundant pilosity. The whole

surface of the body and legs, except the epinotum and dorsalmost portion of the gaster, is covered with erect or suberect whitish hairs. These hairs are most numerous on the upper and lower surfaces of the head, and on the pro- and mesonotum. On the antennal scapes they are rather long but not erect. The pubescence is hardly more abundant than in the typical form. Only the base of the first gastric segment is yellow and the lateral spots on the second segment are barely indicated.

Described from seven workers collected July 2, 1905, at Jamesburg, New Jersey, by Mr. Wm. T. Davis, to whom I take pleasure in dedicating this interesting subspecies. A dozen workers labeled "New Jersey" and received some years ago from the late P. J. Schmitt, O.S.B., are indistinguishable from the preceding. *D. davis*i exhibits such a blending of the characters of the typical *mariae* and *plagiatus* that one is tempted to regard it as a hybrid form. More probably, however, it represents a persisting phylogenetic stage in the development of the typical *mariae* from a *plagiatus*-like ancestor.

Dolichoderus taschenbergi Mayr.

Hypoclinea taschenbergi MAYR, Sitz. B. k. Akad. Wiss. Wien, LIII, 1866, p. 498.

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Hypoclinea taschenbergi MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XX, 1870, p. 958. ♀.

Dolichoderus taschenbergi MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XXXVI, 1886, pp. 436, 437. ♀.

Dolichoderus taschenbergi DALLA TORRE, Catalog. Hymenopt., VII, 1893, pp. 161, 162.

Dolichoderus taschenbergi EMERY, Zool. Jahrb. Abth. f. System., VIII, 1894, p. 330.

Dolichoderus taschenbergi WHEELER, Bull. Am. Mus. Nat. Hist., XX, 1904, p. 304.

Worker (Fig. B).—Length 3.5–4.3 mm.

Head a little longer than broad, elliptical; eyes in the middle of its sides. Clypeus flattened in front, convex behind, with a straight, entire anterior border, slightly impressed in the middle. Antennal scape curved at the base, its tip extending a distance equal to its own diameter beyond the posterior corner of the head. Funicular joints all longer than broad; first $1\frac{1}{2}$ times as long as the second joint, second $1\frac{1}{2}$ times as long as the third; terminal joint a little longer than the two penultimate joints together. Pro- and mesonotum evenly rounded, somewhat depressed, mesoepinotal impression pronounced; basal epinotal surface rather faintly convex, somewhat flattened in the middle, passing over abruptly by means of a very sharp margin into the concave declivity. The margin is slightly convex when seen from above and passes down on either side to the metasternum. Petiole low and thick, not as high as the sharp epinotal margin, with a shorter and more convex anterior, and a longer, flatter posterior surface. Border rather sharp in profile; seen from behind it is

straight and transverse or slightly impressed in the middle. Gaster broad, somewhat flattened above, with straight anterior border and a somewhat deeper constriction between the first and second than between the succeeding segments.



Fig. B. *Dolichoderus taschenbergi* Mayr. Worker.

Sculpture like that of *D. maria*, except that the foveolæ on the meso- and epinotum are somewhat more pronounced. In the mesoepinotal constriction there are a number of regular longitudinal ridges separated by shining depressions. Epinotal concavity without a pronounced

median carina, although the surface is longitudinally striated. Meso- and epinotum opaque or subopaque, pronotum and head shining, gaster very glabrous.

Pilosity and pubescence as in the typical *maria*.

Brownish black, antennæ, edges of mandibles, and legs dark brown.

Types from Louisiana. The species occurs also in Missouri as Emery has shown. The above description is drawn from a single specimen from the latter State in my collection.

***Dolichoderus taschenbergi* Mayr var. *gagates* var. nov.**

Worker. — Differs from the typical form in being deep jet black throughout, with the exception of the edges of the mandibles and the strigils of the fore tibiae, which are yellowish, and the neck of the pronotum which is brownish. The sculpturing of the head and pronotum seems to be less pronounced than in the typical form, so that these parts are smoother and more shining. The gaster is very glabrous.

Described from numerous workers collected at Lakehurst, New Jersey. The same form occurs at Iona (Erich Daecke), Clementon (H. L. Viereck), and Jamesburg (Wm. T. Davis) in the same State.

***Dolichoderus plagiatus* Mayr.**

Hypoclinea plagiata MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XX, 1870, p. 960. ♀

Dolichoderus plagiatus MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XXXVI, 1886, p. 436. ♀

Dolichoderus borealis PROVANCHER, Natural. Canad., V, 18, 1888, p. 408. ♀

Dolichoderus plagiatus DALLA TORRE, Catalog. Hymenopt., VII, 1893, p. 160.

Dolichoderus plagiatus EMERY, Zool. Jahrb. Abth. f. Syst. VIII, 1894, p. 330.

Dolichoderus plagiatus ASHMEAD, 27th Rep. State Board of Agr. New Jersey (1899), 1900, p. 540.

Worker (Fig. C). — Length, 3–3.5 mm.

Head elliptical; eyes rather large, in front of its middle. Clypeus convex,

its anterior border notched and impressed in the middle. Antennal scape curved at the base; tip extending to a distance equal to its diameter beyond the posterior corner of the head. First funicular joint equal to the two succeeding subequal joints together; joints 4-10 nearly as broad as long; terminal a little longer than the two preceding joints taken together. Pro- and mesonotum flattened above, but slightly rounded; mesoepinotal constriction pronounced; basal surface of epinotum in profile higher than the mesonotum, higher behind, somewhat flattened or even impressed near the middle, terminating behind in a sharp margin, below which lies the concave declivity. Seen from above the margin is broadly rounded and passes down on either side to the metasternum. The declivity in profile is not an arc of a circle, as in *mariae* and *taschenbergi*, but has a straight or even convex outline above. Petiole thick, with a shorter and more convex anterior, and a longer, somewhat flattened posterior surface; dorsal border in profile rather sharp, seen from behind, straight and transverse. Gaster rather small, flattened, oval when seen from above, with rounded anterior border. There is a very faint constriction between the first and second segments.

Mandibles glossy, with fine longitudinal striae and coarse punctures. Head and thorax subopaque. Clypeus and front covered with rather sharp longitudinal rugae. Remainder of head and thorax densely punctate-foveolate, the foveolae being so close together on the meso- and epinotum that their surfaces may be described as coarsely reticulate-rugose. Epinotal concavity, petiole, gaster, and legs smooth and shining, very finely shagreened; summit of petiole somewhat opaque and rugose.

Hairs whitish, erect, rather sparse but conspicuous on the mandibles, antennal scapes, upper surface of head and thorax, but less abundant on the gaster and very short and inconspicuous on the legs. Pubescence very sparse and barely visible, except on the gaster and antennae.

Mandibles black, with reddish internal edges. Head, palpi, and antennae black; scape and first funicular joint reddish yellow. Thorax and petiole dark red; meso- and epinotum and border of petiole sometimes black. Gaster black,

with much of the base of the first segment and a large spot on either side of the second segment reddish yellow. In specimens from some colonies the first and second segments are reddish yellow throughout, or with only a dark median cloud on the second segment. Legs reddish yellow.



Fig. C. *Dolichoderus plagiatus* Mayr. Worker.

Female (deâlated). — Length, 4-4.25 mm.

Head very similar to that of the worker. Thorax nearly as broad as the head, with the epinotum shaped like that of the worker, except that the convex basal surface is not so high as the mesonotum and does not slope upward from before backward. Seen from above the sharp margin between the basal surface and concavity is straight and very feebly excised or sinuate in the middle. The foveolae on the head and thorax are pronounced; they are smaller and

somewhat more scattered on the pro- and mesonotum and still more so on the scutellum, and somewhat elongated on the mesonotum; but much larger and almost confluent on the basal surface of the epinotum. Pro- and metapleuræ longitudinally rugose, mesopleuræ very finely punctate-rugulose. Posterior petiolar surface finely and transversely rugose. In one specimen the two basal segments of the gaster are yellow throughout, with a faint fuscous cloud in the middle of the second segment; in another specimen the gastric markings are like those of the worker. Pilosity like that of the worker.

Male. — Length, 4 mm.

Head, including the eyes, broader than long, broadly rounded behind, with prominent ocelli; cheeks short, converging anteriorly. Mandibles well developed. Clypeus with straight anterior border, entire in the middle. Antennæ rather long; scape hardly as long as the two first funicular joints, first joint about half as long as the second, which is distinctly longer than the succeeding joints; joints 3-11 subequal, cylindrical; terminal a little longer than the penultimate joint. Thorax barely as broad as the head through the eyes. Epinotum in profile with somewhat flattened basal and declivous surfaces meeting at a rounded obtuse angle. Petiole decidedly longer than wide or high, blunt above, with a short convex anterior and a long, flat, posterior surface; seen from behind, the upper border is rounded. Gaster elongate-elliptical, more slender than in the worker. External genitalia rounded and lappet-like. Legs long and robust.

Head and thorax subopaque, finely reticulate. Mandibles finely striated. Clypeus and front rather indistinctly punctate-rugulose; posterior portion of head, pro- and mesothorax sparsely foveolate. Pleuræ, scutellum, and epinotum granular. Petiole, gaster, and legs smooth and shining.

Pilosity like that of the worker. Pubescence finer and denser on the gaster and legs.

Head and thorax black, mandibles, antennæ, legs, petiole, and gaster dark brown. Wings whitish hyaline, with yellow veins and stigma, the latter with a dark brown posterior border.

The types of this species are from "Illinois" and are preserved in the Museum of Stockholm.

The above description is drawn from a number of workers collected near Rockford, Illinois, two females, one taken on Staten Island by Mr. Wm. T. Davis and the other at Lakehurst, New Jersey, by myself, and a single male taken at Newport, Rhode Island, by Joseph Leidy (Collection of American Entomological Society). There are workers in my collection from the following localities: Arlington, Virginia; Lakehurst, New Jersey; Iona, New Jersey (Erich Daecke), and Jamesburg, New Jersey (Wm. T. Davis); summit of Torne Mountain, Ramapo, New York (Wm. T. Davis), Lehigh Gap, Pennsylvania (H. L. Viereck), and Colebrook, Connecticut. The species has also been taken in Canada by Provancher and in the District of Columbia by Pergande.

***Dolichoderus plagiatus* Mayr var. *inornatus* var. nov.**

Worker. — Differs from the typical form in having the gaster entirely black, without any indications of the reddish yellow spots of the typical form.

Eight workers from Rockford, Illinois, and a single worker from Lakehurst, New Jersey.

***Dolichoderus plagiatus pustulatus* Mayr.**

Dolichoderus pustulatus MAYR, Verhandl. k. k. zool. bot. Gesell. Wien, XXXVI, 1886, pp. 435, 436. ♂ ♀

Dolichoderus pustulatus DALLA TORRE, Catalog. Hymenopt., VII, 1893, p. 160.

Dolichoderus pustulatus EMERY, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 330.

Dolichoderus pustulatus ASHMEAD, 27th Rep. State Board of Agr. New Jersey (1899), 1900, p. 540.

Worker. — Length, 3–3.8 mm.

Differs from the typical *plagiatus* in its smaller size, less pronounced sculpture and more uniform coloration. Head and thorax shining, with smaller and more scattered foveolæ, except the epinotum, which is coarsely foveolate. Thorax and petiole darker, often nearly black; the spots on the gaster are smaller. There are no erect hairs on the antennal scapes.

Female. — "Length, 4.4 mm."

"Coloration like that of the worker, but the mesonotum, scutellum, and mesopleuræ are blackish brown. Pilosity and sculpture as in the worker, but mesonotum with finer, coriaceous rugosity, and shallower, more scattered foveolæ. The convex basal epinotal surface is separated from the strongly concave declivity by a very prominent transverse ridge, which is feebly emarginate in the middle." (Mayr.)

Recorded by Mayr from New Jersey, District of Columbia, and Virginia. Three workers from Dacosta, New Jersey, from the collection of the American Entomological Society, belong to this subspecies. Mayr included the following variety in his description, as is evident from his mentioning specimens without spots on the gaster.

***Dolichoderus plagiatus pustulatus* Mayr var. *beutenmuelleri* Wheeler.**

Dolichoderus plagiatus MAYR var. *beutenmuelleri* WHEELER, Bull. Am. Mus. Nat. Hist., XX, 1904, p. 304. ♂

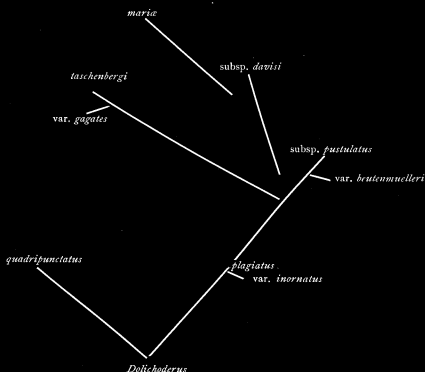
Through a *lapsus calami* in my paper on the ants of North Carolina, this variety was attached to *plagiatus* proper instead of to its subspecies *pustulatus*. From this form it differs merely in the absence of any reddish-yellow markings on the gaster and hence in exactly the same way as the var. *inornatus* differs from the typical *plagiatus*. The antennal scapes have a few conspicuous erect hairs, especially on their flexor surfaces.

The types are from the Black Mountains of North Carolina (Wm. Beutenmüller). I have also taken several workers in various localities

in the pine-barrens about Lakehurst, New Jersey. I have received from Mr. H. L. Viereck a single female belonging either to this variety or to the preceding subspecies. It was collected at Pablo Beach, Florida, April 8, by Mr. P. Laurent. As the gaster is lacking, the specimen cannot be more accurately identified.

THE RELATIONSHIPS AND HABITS OF THE NORTH AMERICAN
DOLICHODERI.

A comparison of the foregoing *Dolichoderi* with one another and with the palæarctic *D. quadripunctatus* suggests a common ancestral form for both the Old and New World species. *D. plagiatus*, especially, seems to be very closely related to *quadripunctatus*; the males of the two species being, in fact, almost indistinguishable. Among the American species we can pass, on the one hand, from the highly foveolate *plagiatus* through successively smoother subspecies like *pustulatus* and *davisi* to the very smooth and brightly colored *maria*. The typical *taschenbergi*, on the other hand, with its extremely melanistic variety *gagates*, may also be derived from some smoother form of *plagiatus*, like *pustulatus*. These hypothetical derivations are indicated in the following diagram:



The habits of the palaearctic *D. quadripunctatus* have been studied by Latreille and Forel. Latreille's observations were embodied in a remark that the species is frequently found on old tree-trunks and that its societies are very small ("très-peu nombreuse").¹

Forel has given a much more satisfactory account of this ant.² He finds that it is one of the components of a walnut-tree ant-fauna, which comprises also *Colobopsis truncata* and *Leptothorax affinis*. It nests in the wood or bark of dead branches in colonies which are rather small though much larger than the colonies of *Colobopsis*. As soon as the morning has grown sufficiently warm the workers descend the trees in files and distribute themselves over the surrounding plants where they lap up the sweet exudations from flowers, leaves, and twigs. Forel did not see them attending aphides. When disturbed they timidly crouch in the crevices of the bark. He is inclined to believe that the close superficial resemblance between the minor workers of *Colobopsis truncata* and the workers of *D. quadripunctatus* is due to mimicry. Not only are these two ants, belonging to very different genera and even subfamilies, the only European species with spotted gasters, but they closely resemble each other also in gait, stature, and behavior. Forel found as many as nine different nests of *D. quadripunctatus* in the dead branches of a single walnut tree. When workers from seven of these were placed in the same box, there were no hostilities. He concludes, therefore, that all of these nests belonged to the same colony. In other words, the colonies of this species are polydomous, but each colony contains several dealated females.

While Forel's statements go to show that the European *Dolichoderus*, like many of the tropical species, is strictly arboreal, the observations I have been able to make on our American species reveal some interesting and important differences. These observations show very clearly that our *Dolichoderi* represent at least three separate species, which are ethologically as well as taxonomically quite distinct from the palaearctic form.

The workers of *D. plagiatus* and its subspecies and varieties are occasionally found in small companies, running over the leaves of bushes and young trees in the sunny clearings of our northern woods. They lick the surfaces of the leaves wherever they are covered with honey-dew, *i. e.*, the excrement of aphides, and undoubtedly also

¹ Histoire Naturelle des Fourmis, Paris, 1802, p. 181.

² Fourmis de la Suisse, 1874, pp. 286-288, and Variétés Myrmécologiques, Ann. Soc. Ent. Belg., Tome XLV, 1901, pp. 380-382.

collect the sweet substance directly from these little insects. On only one occasion have I been able to find a nest of *plagiatus*. While walking on the summit of one of the Litchfield hills near Colebrook, Conn., my attention was arrested by an unusually large number of workers (about forty) of this species clustered about some aphides on the lower surface of the leaves of a very young chestnut tree. I carefully followed the ants as they left the aphides in a straggling file and descended the tree trunk. They ran over the twigs and dead leaves and finally disappeared in a little depression in the ground about eighteen inches from the base of the tree. This depression was so well concealed under the dead leaves and twigs, that it would never have been seen without following the foraging ants. It contained between sixty and seventy workers, a number of worker larvæ and pupæ and a few callows. Many of the ants, together with the green leaves covered with aphides, were confined for a few days in an artificial nest where they could be readily seen imbibing the drops of sweet liquid from the anal openings of the plant-lice. When disturbed the ants behaved like *D. quadripunctatus*; that is, they crouched with folded antennæ in the depressions on the under sides of the leaves. Careful search failed to reveal any other colony of *D. plagiatus* in the neighborhood, and as I have never seen larger companies of these ants whenever I have found them in other localities, I feel certain that they never form large colonies. In this respect *plagiatus* resembles the European species, but though our American species still retains the ancestral habit of seeking its food on trees and bushes, it no longer nests in dead wood but in the soil.

These habits are much more strikingly displayed by *D. mariæ* and *taschenbergi* var. *gagates*. As these ants are among the most beautiful and conspicuous inhabitants of that botanical and entomological paradise, the New Jersey pine-barrens, it is surprising that none of the collectors who annually visit that region has taken the pains to observe and publish an account of these insects. Both *mariæ* and *gagates* are about equally abundant and, except in a few particulars, have identical habits. The colonies are very large, comprising thousands of individuals, and strictly monodomous—that is, restricted to a single nest. The nest is excavated in the pure sand, nearly always about the roots of the broom beard-grass (*Andropogon scoparius*) (Plates XII and XIII) or of the liliaceous "turkey-beard" (*Xerophyllum setifolium*), so characteristic of the pine-barrens; more rarely about the roots of small bushes or in remnants of pine stumps. The workers remove nearly every particle of sand from the roots and dig a

pot-shaped cavity from 12-18 inches in depth and 3-5 inches in diameter. (Plate XIII, Fig. 2.) The spaces between the root-fibres serve as galleries and in them the larvæ and pupæ are kept. The withdrawal of so much sand from the roots of the grass often destroys the vigor of the plant and prevents it from flowering. Bits of dead leaves, pine-needles, etc., are heaped over the surface between the grass-blades sometimes in sufficient quantity to form a flat mound, but quite as often the top of the nest is concave owing to the withdrawal of the sand and its being only partially replaced by vegetable débris. One large nest of *gagates* about ten inches in diameter was seen in the open woods surmounted by a flat mound consisting exclusively of flakes of charred pine bark which the ants had collected and placed not only on the top of the nest but between the root-fibres to a depth of a foot. On warm, sunny days, the workers bring their brood so near the surface that the maturer pupæ may be exposed to the light, while the ants themselves bask in the sun in a great mass among the bases of the grass-stems. At such times a *gagates* colony sparkles like a mass of jet beads and a colony of *maria* is even more beautiful, as it reflects the sunlight from thousands of bright-red and blue-black bodies.

The nests are most easily located by first finding the ants on the foliage of some one of the numerous oaks (*Quercus nana*, *obtusiloba*, *marylandica*, *prinoides*, etc.) or pines (*Pinus rigida* and *inops*) so characteristic of the barrens. A few hundred *gagates* or *maria* may be seen attending aphides or coccids (*Chermes*) on a branch of one of these trees and thence traced in an uninterrupted file descending the trunk and moving over the white sand, dead leaves, and pine-needles sometimes a distance of 30-50 feet to the nest. Often several files go out from the same nest in different directions to as many different trees. From the large *gagates* nest above described six files were seen radiating and traversing the barren ground for distances varying from 20 to 40 feet before they reached their respective trees.

Although these ants subsist very largely on the excrement of plant-lice and coccids, they are also very fond of insect food. A caterpillar or dead insect dropped near one of their files is soon completely covered with ants and devoured *in situ*. It is probable that the aphides and coccids within a radius that can be conveniently patrolled by a single colony are far from being sufficient to supply its thousands of workers with food. Hence the colonies must from time to time move to new localities and excavate fresh nests. That this is not infrequently done is shown by the following

observations: First, several large nests which I located during September, 1904, were found to have been deserted when I revisited them during August, 1905. Second, in a particular locality the number of abandoned is much greater than the number of inhabited nests. Third, on September 16, 1905, I actually saw a large colony of *maria* in the act of excavating a new nest in a bunch of grass. Such changes of domicile can be readily effected on account of the simple architecture of the nest and the ease and rapidity with which the sand is excavated. Both *maria* and *gagates* resemble the species of *Eciton* not only in their habit of moving everywhere in files and their probably not infrequent changes of domicile, but also in the singular habit when in their nests of hanging to one another by means of their claws till they form bunches sometimes nearly as large as one's fist.

These ants resent any disturbance of their nests with all the power of their mandibles and anal glands. The secretion from the latter seems to be very volatile and does not have the rancid butter or "Tapinoma odor" of many Dolichoderinæ, like the species of *Tapinoma*, *Forelius*, *Iridomyrmex*, *Dorymyrmex*, *Liometopum*, and some of the tropical species of *Dolichoderus*, but a peculiar smoky or pungent odor, fainter in *maria* and stronger and of a somewhat different character in *gagates*.

It is difficult to keep these ants in artificial nests of the Fielde or Janet patterns, as they seem to be very restless and so indifferent to the sunlight that the chambers cannot be readily opened or cleaned. The original Lubbock nest, with its contrivance for permitting the ants to seek their food on an open platform, would probably be better adapted to both of the species.

The sexual phases of *maria* and *gagates* make their appearance at different times. I infer this from the fact that on August 19 and 20, 1905, I found the nests of *maria* containing male and female pupæ, many mature males, and quite a number of callow females. Single dealated and winged females were also seen running over the sand, so that August 20 is approximately the date of the nuptial flight of this species. On September 16 and 17 I again opened several nests but in only one did I find sexual forms. These were all mature, apparently belated females, and there were only worker pupæ. The nests of *gagates*, however, were searched in vain on all of these dates for males and females and their pupæ. It is certain, therefore, that the colonies of this variety throw off their winged phases earlier in the summer, probably during July and early August. In my collection there is a male *Dolichoderus* taken June 29, 1905, at Lakehurst, New

Jersey, by Mr. Wm. T. Davis. It may be the male of *gagates*, but it differs so little from the male of *mariæ* that I have refrained from describing it. I hope to obtain the males and females of *gagates* by a more timely visit to the pine-barrens during the summer of 1906.

EXPLANATION OF PLATES XII AND XIII.

PLATE XII.

FIG. 1.—Nest of *Dolichoderus taschenbergi* var. *gagates* concealed in a tuft of grass (*Andropogon scoparius*).

FIG. 2.—A similar nest of the same ant showing the accumulation of vegetable débris between the grass-blades. About $\frac{1}{4}$ natural size.

PLATE XIII.

FIG. 1.—Nest of *Dolichoderus mariæ*. About $\frac{1}{3}$ natural size.

FIG. 2.—Nest of the same species partially opened and showing the débris accumulated in the middle and the denuded condition of the grass-roots to make room for the ants and their brood.